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MEMORANDUM

TO: Dan Williams, P.E.
Director of Engineering

FROM: Donald S. MacLean, P.E. *DJM*
Acting Traffic Manager

DATE: November 14, 2012

RE: MD 200 - Intercounty Connector
Posted Speed Limit Evaluation and Recommendations

PURPOSE OF MEMORANDUM:

☒ To update you about an ongoing/new issue
☐ To request a meeting
☒ To provide backup materials for an upcoming meeting
☐ Need your decision

SUMMARY:

An engineering study has been conducted in order to review the operational and engineering issues associated with raising the posted speed limit along MD 200 (the Intercounty Connector, or ICC) from 55 MPH to 60 MPH. An independent evaluation performed by Kittelson & Associates, Inc. recommends performing a review of the 1-year crash history before implementing a posted speed limit of 60 MPH along the facility. If the study finds no crash trends attributable to speeding, we recommend a Speed Limit of 60 MPH be enacted for mainline MD 200. We are also recommending the installation of both mainline and ramp curve warning signs and advisory speeds.

BACKGROUND

The Intercounty Connector is a six-lane, limited access, divided highway extending over 17 miles from I-370 to US 1. The western 16 miles of highway, west of I-95 was opened to public travel in November 2011 and the portion from I-95 eastward to US 1 is currently under construction. Current traffic volumes are between 20,000 and 30,000 vehicles per day however projected traffic volumes are expected to reach 100,000 vehicles by 2030.

The Intercounty Connector was designed and constructed with a 60 MPH design speed and opened with a 55 MPH posted speed limit. Since November 2011, customers and external constituencies have requested that the MDTA consider increasing the posted speed limit on the Intercounty

Connector. This memorandum documents the findings of an engineering study of the ICC speed limit taking into consideration free-flow vehicular speeds, physical roadway and roadside features, safety performance history and anticipated changes to roadway conditions.

DISCUSSION/ANALYSIS:

There are several engineering guidelines governing the establishment of safe and effective speed limits:

- A speed limit established by engineering study should be within 5 MPH of the 85th percentile speed (defined as the speed below which 85% of motorists are traveling).
- A speed limit should be established based on the physical geometry and safety characteristics of the roadway.
- Speed limits should be reasonable and encourage compliance by a majority of motorists.

These objectives frequently lead to competing objectives which must be balanced when establishing the speed limit. The Intercounty Connector as-built construction plans as well as existing traffic speeds were evaluated in order to assess each of these objectives.

1. An analysis of *existing travel speeds* at all toll gantries (see Table 1 attached) between January 24, 2012 and January 26, 2012 indicates that:
 - a. 85th percentile speeds ranged between 64 MPH and 67 MPH.
 - b. 50th percentile speeds ranged between 59 MPH and 61 MPH.
 - c. Depending on the toll gantry location, between 12% and 25% of vehicles were obeying the posted speed limit during this time period.
2. An analysis of *existing travel speeds* at all toll gantries between June 24, 2012 and June 30, 2012 indicates that:
 - a. 85th percentile speeds ranged between 66 MPH and 69 MPH
 - b. 50th percentile speeds ranged between 60 MPH and 62 MPH
 - c. Depending on the toll gantry location, between 9% and 18% of vehicles were obeying the posted speed limit during this time period.

The apparently low level of compliance with the posted speed limit combined with 85th percentile speeds that are 10 MPH above the posted speed limit indicate that raising the speed limit to 60 MPH would be a prudent step. This will encourage driver compliance with the posted speed limit and encourage a reduction in the discrepancy between minimum and maximum observed speeds.

3. An *accelerometer* was used to measure lateral acceleration of vehicles at eight horizontal curves identified as possible concerns. These readings indicate that for each of the following three (3) curves the existing curve warning signing should be evaluated in detail to determine

the advisory speed that should be established. Curve warning signs already exist at these locations, however the signing will be compared to the most recent MUTCD requirements prior to increasing the speed limit. Two of the curves are on mainline MD 200 between I-370 and MD 97, therefore we reviewed the 2012 crash history for this section and none of the reported crashes identify vehicular speeds as the primary cause.

Curves along the I-370 to MD 97 Segment

- a. MD 200 at Redland Road
- b. MD 200 at Muncaster Mill Rd

Curves along the MD 97 to I-95 Segment

- c. MD 200 to I-95 SB Ramps

- 4. An evaluation of the *physical roadway and roadside conditions* identified areas requiring modification or study prior to a posted speed limit modification, these areas of concern include:
 - a. Ten exit ramps may require advisory speed and curve warning sign revisions due to the differential between the mainline roadway and ramp safe driving speed. A determination of the proposed advisory speeds for each ramp is under way and will be completed within the next 2 to 3 weeks.
 - b. Four areas along the mainline roadway where clear zones are constrained and drivers of errant vehicles may not have adequate distance to stop or otherwise regain control of the vehicle before impacting an obstruction or drop off. W-beam Traffic Barrier or another positive barrier protection may be needed. I estimate 120 days for implementation, including 30 days for design and 90 days for construction.
- 5. Due to the low volume of existing traffic and limited time to collect and evaluate safety performance, *the maximum speed at which a motorist could theoretically drive* a vehicle without departing the travel lane was calculated. This “inferred speed” methodology is documented in the Federal Highway Administration’s, “Speed Concepts: Information Guide”.
 - a. An inferred speed of 59 MPH was calculated for a 2,000 foot segment of curve along the westbound Intercounty Connector near Redland Road. A review of 2012 crashes along this stretch of roadway indicates that there have been no crashes with a primary cause attributable to speeding.
 - b. West of MD 97 an inferred speed of 60 MPH was calculated for seven (7) horizontal and vertical curves.
 - c. An inferred speed of 60 MPH was also calculated for five (5) vertical curve segments between MD 97 and MD 650.
 - d. East of MD 650 to I-95, the calculated inferred speed exceeded 60 MPH.
- 6. Lacking historical crash reports to complete a safety analysis, the Texas Transportation Institute, “Roadway Safety Design Workbook” and National Cooperative Highway Research

Program Study 17-45, "Enhanced Safety Prediction Methodology and Analysis Toll for Freeways and Interchanges" methodology was utilized to predict the number of injury and fatal crashes per year based on a range of speed limits, forecast and existing traffic volumes and various geometric design elements known to be correlated with crash frequency.

The ***predictive crash analysis*** was completed for the four segments of roadway with the lowest calculated inferred speed. These roadway segments have the lowest safe operating speed and therefore will be most susceptible to speed related crash increases. The analysis projects a very slight increase in the number of crashes per year if the posted speed limit was increased to 60 MPH. By comparison, the projected crash rate increases significantly with the projected increase in traffic volumes on the facility.

RECOMMENDATIONS:

With the primary objective being to safely improve alignment of the posted speed limit and the 85th percentile speeds of drivers, I have the following recommendations:

1. I recommend that one year following the opening of the ICC to traffic (i.e. December 2012/January 2013) a ***detailed crash analysis be performed for the entire length of MD 200.*** This study should evaluate if there are any crash trends which could be attributable to excessive speeds and make further recommendations regarding the need for additional engineering, enforcement and education measures.
2. Provided that there are no concerns identified in the crash study, I recommend increasing the posted speed limit to 60 MPH provided that the following implementation steps take place:
 - a. Each of the twelve 12 horizontal and vertical curves along Mainline MD 200 which were identified in the study with a calculated inferred speed of 60 MPH (and one at 59 MPH) should be evaluated for posting curve warning signs and advisory speeds.
 - b. All of the exit ramps should be evaluated for posting of curve warning signs and advisory speed changes.
 - c. The roadside clear zone should be evaluated at the four (4) locations identified in the report and a formal determination made on the need for additional traffic barrier.

The evaluation of ramp advisory speeds is already under way and I estimate the design and installation of additional curve warning signs and advisory speeds will take 90 days to accomplish (30 days design and 60 days fabrication and construction). I estimate 120 days to design and install additional W-Beam Traffic Barrier where there are clear zone obstructions. These two efforts can be run in parallel, therefore the total time to implement a speed limit change is estimated to be 120 days.

3. A ***speed limit study every five years*** is recommended for roadways that undergo significant geometric or use changes. Once traffic volumes on the Intercounty Connector have normalized

and a crash history is developed, an engineering study of the posted speed limit should be conducted.

4. **Regular monitoring of speeds** should be performed in order to watch for any increases in vehicular speeds along the roadway. If vehicular speeds increase above the existing 85th percentile levels, additional education and enforcement measures should be discussed with Media, Operations and the MDTA Police.
5. A detailed ***follow-up study of the impacts*** of the speed limit increase should be performed one year after the increase is enacted. This study should evaluate the safety impacts as well as monitor driver behavior with regard to speeds along the roadway.
6. A modification of the posted speed limit will affect day to day operations of the Police, Operations and Communications Divisions; a joint review of these findings should be completed prior to developing a final recommendation.

ATTACHMENTS:

1. Table 1 – ICC January 2012 vs. June 2012 Speed Summary by Toll Gantry

COMMENTS:

___ Ok to schedule
___ Invite:
___ Comments:

Update February 1, 2013:

- A detailed crash study was completed on January 23, 2013. See report for additional information.
- It was confirmed that the need for additional curve warning signs along mainline and the ramps are not required. It was determined that the existing signs are adequate.
- It was confirmed that the need for W-beam Traffic Barrier or other positive barrier protection is not required in the four areas along the mainline roadway where clear zones may have been constrained. This was verified by a detailed review of the Plans, and by visiting each location in question.
- The speed limit increase will be fully implemented by March 31, 2013.

Table 1. ICC January 2012 vs June 2012 Speed Summary by Toll Gantry

Toll Gantry	Closest Cross Street	January 24 - 26, 2012					June 24 - 30, 2012				
		85th Percentile Speed	50th Percentile Median Speed	Average Speed	15th Percentile Speed	Percent of Vehicles (Speed ≤55mph)	85th Percentile Speed	50th Percentile Median Speed	Average Speed	15th Percentile Speed	Percent of Vehicles (Speed ≤55mph)
1 - EB	Redland Road	64.5	58.9	59.4	53.1	24.3%	66.6	60.4	61.0	54.3	17.9%
5 - EB	Longmead Crossing Drive	65.8	60.3	61.0	55.3	13.7%	67.9	61.6	62.4	56.2	10.6%
7 - EB	Bonifant Road	66.0	60.4	61.1	55.3	13.5%	68.2	61.8	62.7	56.5	9.2%
9 - EB	MD 650/New Hampshire Ave	66.4	60.8	61.5	55.7	11.7%	68.5	62.0	63.0	56.7	8.8%
13 - EB	Old Gunpowder Road	66.2	60.4	61.1	55.1	14.6%	67.8	61.4	62.2	55.7	12.1%
4 - WB	Muncaster mill Road	64.5	59.5	60.1	54.6	17.3%	66.9	61.1	61.9	56.0	10.8%
6 - WB	Longmead Crossing Drive	64.7	59.6	60.2	54.7	16.5%	67.0	61.2	61.9	56.0	11.0%
8 - WB	Notely Road	64.7	59.6	60.2	54.7	16.4%	67.1	61.2	62.0	56.1	10.6%
10 - WB	MD 650/New Hampshire Ave	64.8	59.7	60.4	54.8	15.7%	67.1	61.2	62.0	56.1	10.6%
14 - WB	Old Gunpowder Road	65.1	59.8	60.5	54.9	15.6%	67.1	61.2	62.0	56.0	10.9%
Average		65.3	59.9	60.6	54.8	15.9%	67.4	61.3	62.1	56.0	11.2%

- Units of speed data are in miles per hour.
- January speed data at each toll gantry location are from January 24, 2012 (Tuesday) to January 26, 2012 (Thursday).
- June speed data are from June 24, 2012 (Sunday) to June 30, 2012 (Saturday).
- 85th Percentile Speed - the speed at or below which 85 percent of the motor vehicles travel (MUTCD).
- Average Speed - the summation of the instantaneous or spot-measured speeds at a specific location of vehicle divided by the number of vehicle observed (MUTCD).